A STUDY OF THE FLORA OF KEY BISCAYNE, DADE COUNTY, FLORIDA

BY

BIRDIE McALLISTER

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H. McA.

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A STUDY OF THE FLORA OF KEY LARGO

DADE COUNTY, FLORIDA

INTRODUCTION

The Florida Keys have long been a paradise for botanists who desired to study the tropical and subtropical flora. Key Biscayne, one of the upper sand keys, has not been the subject of any intensive study, chiefly because it has been in private hands since 1800. This has been a boon in that there has been no wholesale destruction whereby the flora has suffered at the hands of developers. Although most of the well-drained higher part of the Key has been cleared and planted in coconuts, ample natural areas have been left around the edges and in palmetto thickets and swamps so that some aspects of the native vegetation can still be reconstructed.

With the recent trend toward further economic development in this section, it is no doubt only a matter of time before Key Biscayne will be completely cleared. Plans are in the offing for the development of Virginia Key as an International Airport and for other commercial purposes. If these plans materialize, it can only be a short time before Key Biscayne, too, will fall into the hands of developers, as it is only separated from Virginia Key by Bear's Cut, a narrow waterway across which a bridge or causeway could easily be constructed.

The writer agrees with Harshberger (1911) that "it is important for this generation of botanists and scientists to leave a record of the original appearance of the country before the march of civilization has destroyed primeval conditions".

Collections of the native plant life of Key Biscayne have been made over a period of two and a half years, the work beginning in the fall of 1935 and extending through the spring of 1938. The midsummer collections have of necessity been quite limited. However, as the seasonal factor is not of the greatest importance in this tropical region, the majority of the plants which do not flower the year round have been obtained in flower or fruit by the last of May. All parts of the Key were visited and, where possible, trips were made in the fall and the late spring to the same habitats. The specimens have been deposited in the Duke University Herbarium.

In identification and nomenclature, Small's Manual of the Southeastern Flora (1933 edition), Small's Flora of the Florida Keys (1913), and Small's Ferns of Florida (1931 edition) were used, except for Cyperaceae where Dr. Hugh O'Neill's identification and nomenclature were used, when they were at variance with Small's. Mr. W. M. Buswell, Curator of the University of Miami Herbarium, and Dr. Walter S. Phillips, Professor of Botany at the University of Miami, assisted the writer with many difficult specimens, permitted the use of the herbarium of the Florida flora at the University of Miami, and assisted with ecological problems peculiar to south Florida.

Dr. H. L. Blomquist identified or checked the determinations of the grasses.

DESCRIPTION OF KEY BISCAYNE

Key Biscayne lies in Biscayne Bay six miles due east of Coconut Grove, which is a part of Greater Miami, but four miles south of Miami proper. The Key is five miles long and varies in width from three-fourths to two miles. It is at the northeastern end of the islands of the Florida Reef, which extends from Dry Tortugas to Virginia Key. These islands are collectively known as the Florida Keys. The upper islands, namely Key Biscayne and Virginia Key, are designated "Upper Sand Keys". These two Keys are at the southern end of the east coast strip and are merely detached portions of the slender coastal peninsula. Key Biscayne lies at the southern extremity of what might best be described as a sandy barrier beach, Biscayne Bay separating it from the mainland (Harper, 1927). For convenience, Small includes the plants of these two Keys in his "Flora of the Florida Keys". However, from an ecological and geological viewpoint, the flora bears a closer relationship to the plant associations from Miami Beach northward to Palm Beach than to those of the Keys south of Miami. The true coastal vegetation begins at Cape Florida, which is the southern tip of Key Biscayne, and extends through

Virginia Key and Miami Beach, forming an almost continuous association to Hillsboro Inlet, where a high frontal dune begins. At varying heights it extends on to Palm Beach and Jupiter.

As very little has been written about this Key, the writer has found it necessary to get much of the historical information verbally. Chief contributors have been Captain Richard Carney, one of the original planters of the Key; Mr. Hugh Matheson, one of the three joint owners of Key Biscayne; Mr. A. T. Sherwood, the present Superintendent, who has lived on the Key over eight years; and Mr. George Gordon, who has lived on the Key fifteen years, and who, during that time, has developed a very successful apiary.

The island was originally granted to Pedro Fornella in 1800 by the British Government. It comprises 2083.7 acres of which 300 acres of the lower part, known as Cape Florida, were bought by the Davis family in 1824. For those who associate real estate booms only with recent years, it is of interest to note that probably the first Florida boom was in 1836, when Mr. Davis subdivided his part of the Key, selling lots for as much as a thousand dollars apiece (Munroe, 1930). Later, this part plus an additional 175 acres were bought by the Deerings. The Deering heirs still own the southern portion of the Key.

The remaining 1708.7 acres were acquired by the Osborne family and in 1908 this acreage was bought by Commodore William Matheson, whose heirs still control it (Records of Dade County Courthouse). It is this latter 1708.7 acre tract

with which this study is concerned in most detail, though observations and collections have been made south of the canal on the Deering's part of the Key.

While it was owned by Mr. Osborne, the first cultivation was attempted. Osborne, Fields and Carney planted 78,000 coconuts beginning in the spring of 1883. According to Captain Carney, this attempt was not successful as the rabbits and rats were too destructive. After a year they gave up further efforts.

Later, after an unsuccessful attempt to interest Henry Flagler in Key Biscayne as an exclusive hotel site, the Commodore in 1910 began the first permanent planting of coconuts. The use of the Key as an experimental plantation has doubtless been for the greater good of the Key as a whole (Munroe, 1930). The Commodore brought to the island countless rare and exotic plants and animals which he acquired on various world expeditions. Many of these rare plants are still there and thriving. In many cases it is difficult to distinguish native plants from introduced ones, because the latter have so well adapted themselves to local conditions.

Geologically, there is little information available about Key Biscayne. Since this study began, a storm house large enough to accomodate all the inhabitants on the Key has been erected. It is 900 feet from the high water mark on the ocean front. The engineers went down 24 feet 3 inches before they struck rock which was of coral formation. The strata

they encountered were as follows: 1 to 3 inches of top soil consisting of sand and black loam, 3 to 4 feet of yellow sand, 5 inches to 1½ feet of sandy hardpan. From here on down there were many narrow strata, varying from 2 inches to 6 inches in thickness. The composition of these strata in the order of their sequence includes shell formation, gray sand, hard pan, shale of flaky, lime rock, sand, shell, hard pan of shell, gray sand, and coral rock. The above confirms the findings of engineers who made borings south of the Old Light House on Cape Florida, which is the southermost tip of the Key (Watson, 1915). They report that the same coral formation that is the base there is the base of both Key Biscayne and Virginia Key. Other borings taken every 100 feet across Biscayne Bay to Virginia Key showed four definite strata of varying depths: first stratum, sand and mud; second stratum, sand and loose rock; third stratum, soft rock; fourth stratum, hard rock of coral formation (Data from chart at Dade County Court House, giving borings along the center of the proposed viaduct of the International Airport in Biscayne Bay).

The shoreline of Key Biscayne has been definitely shaped as a result of the joint work of currents, waves, and winds. These factors have left a very decided effect on the ocean side of the island. Probably the best example of this action was given by the 1926 hurricane, when the ocean beach lost from 100 to 200 feet due to the washing away of the sand. The flora in turn shows a definite reaction to these forces

of nature.

The nearest official weather station is on the mainland at Miami, where the weather conditions vary from those of the Key. In the summer the temperature is usually from 1° to 3° F. higher than on the mainland. During very cold spells when the thermometer readings were unofficially kept over the entire period by the Superintendent and compared with those of the Miami weather bureau, those of the Key were on an average of 3° to 5° higher than Miami's. For Miami, over a period of 39 years the average annual temperature has been 78.2° F. The average for January was 67.7° F. and for July 81.7° F. Over a period of 51 years the average annual rainfall has been 60.26 inches, 49.4% falling from June to September, 75.3% falling from May to October. The distribution curve shows that there are 2 maximum periods of rainfall, a lesser one in May and June and a higher one in September and October. However, the rainfall is so regulated from November through April that droughts are rare (Florida section of the United States Weather Bureau from the 18th Annual Report of the Florida Geological Survey, 1927 and the 1935 Annual Meteorological Summary of the United States Department of Agriculture with comparative data for Miami, Florida).

The average relative humidity for a 25 year period was 78% at 8 A. M., 66% at noon, and 74% at 8 P. M. During the entire 25 year period the greatest variation at 8 A. M. was 7%, at noon 8%, and at 8 P. M. 6%.

The topography of the Key is quite regular. The elevation is from 0 to 7 or 8 feet above sea level. This slight range in elevation, however, is sufficient to produce associations of quite varied nature.

According to Dr. John C. Gifford, Professor of Tropical Forestry at the University of Miami, who went over with Commodore Matheson in 1908 before he bought Key Biscayne, the sandy bank along the shore was covered with saw palmetto and cabbage palmetto, sea grapes, and cocoplums with sea lavender, Cakile, and sea oats in abundance. The back land was for the most part swampy with very dense growths of palmettoes fringing off into mangrove swamps of buttonwoods, white, black, and red mangroves. In the higher elevations of the inner region were many slash pines with the palmettoes. Since then, most of the higher, well-drained parts of the island have been cleared for coconut cultivation. There are still many of the palmettoes but only one native pine has been seen since this study began. According to the present inhabitants of the Key, many of the pines have been used for lumber and because of their reputed inability to endure excessive salt water and spray, all the remaining ones were killed in the 1926 hurricane.

South of the canal which divides the Key into two distinct parts, the flora has been practically undisturbed by man. There are extensive growths of palmettoes directly back of the beach vegetation. These are interspersed with many plants common not only to these habitats but also to the low

coastal hammocks. Beyond the palmetto thickets, mangrove swamp again appears and extends to the Bay.

THE PLANT ASSOCIATES OF KEY BISCAYNE

The flora of any section is the total of all plants covering the area. It is a group of plants which has resulted from the interaction of a number of factors; namely, climatic, topographic, edaphic, and biotic (Nichols, 1923; Weaver and Clements, 1929).

The climatic factor rather uniformly affects all the associations of Key Biscayne. Topography varies from 0 to 7 or 8 feet in elevation. It would probably be more correct to say that it varies from several feet below sea level to 8 feet above, when mangrove swamps are considered, with a young red mangrove sometimes starting 10 feet or more from shore and having roots several feet under water at high tide. The soil is principally sandy. Fine sand covers most of the Key, a coarser sand covers the coastal strand, while fine, sandy loam is found in mesic areas that are slightly lower. In the interior of the mangrove swamp where the soil is exposed at low tide, the soil is sand and black mud. In this region of little relief and low surface, the elevation of a few feet produces a noticeable change in vegetation as the water-holding capacity of the soil is changed (Harshberger, 1914; Fuller,

1914).

There are several drainage ditches which have made arable many of the low areas that would otherwise be swamps. While these are too recent to show any very definite effects on the flora, there are indications of a transition from swampy vegetation to a mesic type.

There is some evidence of fires in former years. As there is so little known of the past history of the flora, it is rather difficult to use this factor in any definite way in this study.

The vegetation types of the island may be grouped into several communities. On the ocean side is the barrier beach or coastal vegetation which is further divided into three parts: the beach, the beach ridge and ridge complex communities. The beach ridge community is homologous to the dune vegetation between Miami Beach and Palm Beach. It varies from a narrow, low, dune-like expanse in some places to a dense ridge complex (Cowles, 1901) which may extend half way across the island. Many species of the beach ridge point to a close relationship to the low coastal hammocks, though the vegetation does not seem typical enough to classify any section of the Key as a true hammock.

Another community may be called a thicket or better still a palmetto bushland, though within the memory of present inhabitants of the Key, it was pine-palmetto land. Mayr describes palm-bushland that occurs in America and is composed of Serenoa serrulata (= S. repens): this palm stretches over the ground

and clothes sterile sand, on which forest composed of Pinus australis and P. cubensis (= P. caribaea) had formerly grown until destroyed by fire or felling operations" (Harshberger, 1914). Harshberger (1914) points out the relationship between palmetto vegetation of south Florida and that of the coastal bushland or maqui of the Mediterranean region. Much of the thicket or palmetto bushland area on Key Biscayne has been cleared and planted, some of the uncleared sections being on high land, while others are in low swampy places.

The cleared fields, which are planted with coconuts, constitute the greater part of the inland mesic area. The water table of the interior of the Key, much of which was formerly a pine-palmetto growth, has been so regulated through drainage that conditions are almost ideal for coconut cultivation. There has been little cultivation since the original clearing unless undergrowth interferes with the coconuts. The second growth in these parts is similar to that in the native areas nearby.

Mangrove swamps dominate most of the quieter waters of the Bay side and are an important element in the flora of Key Biscayne. They are characterized by an outer rim of low trees with rounded tops and numerous aerial roots, growing downward either into shallow water or into marl flats. The typical trees of the swamps are the three mangroves, red, black, and white, usually accompanied by buttonwood. In places the swamp extends from a fifth to a third of the way across the Key. Though this area is only about a fourth of

the entire island, it is by far the most interesting to most botanists, first, because of the unique and unusual adaptations of so many of the plants to their mode of life and secondly, because of the importance of some of these trees as land builders. If the same thing is happening here that ecologists say has happened elsewhere in Florida, these mangrove swamps will eventually develop into other types of vegetation.

Much of the flora of Key Biscayne is similar to that of the Bahamas and the West Indies, while many of the plants have drifted in from Central America, the northern part of South America, and western Africa (Harshberger, 1911; Record, 1914).

On a recent coast to coast trip through Cuba, the writer was impressed by how much more the plants of south Florida and the Keys resembled those of Cuba than those of Central and Northern Florida. Very few of the species even resemble those found in other parts of Florida.

As a large number of the species are tropical and as frost is almost unknown, the flora of Key Biscayne looks much the same the year round, though many of the herbs would not be called evergreen if they grew in the northern states.

The collections made the past 2½ years during the periodic trips to the Key include 231 species of plants. These include 178 dicotyledones, 47 monocotyledones, 1 conifer, 1 cycad, 3 ferns, 1 moss, and several unidentified lichens. In 47 instances there was only one genus to a family. There were 169 genera which had only one species.

The Coastal Region

The east side of the Key, which borders on the Atlantic Ocean, is a barrier beach made up of a series of low sand dunes which are more or less changed in height, position, and floral composition with each severe storm. The vegetation of the coastal region is divided topographically into three communities, beach, beach ridge, and ridge complex.

Beach

The beach consists of three parts: the lower or front beach, the middle beach, and the upper beach (Cowles, 1901; Harshberger, 1914). The lower beach has a gradual slope seaward but has no floral inhabitants, as it is submerged at high tide. The middle beach varies much in width. Where very narrow, there are usually no plants, but on wider stretches of the upper part of the middle beach, the most frequent invaders include railroad vine (Ipomoea Pes-Caprae), bay bean (Canavali lineata), and a grass, which has never been found in fruit, though observed at all seasons. The first two have tough bilobed leaves and fleshy trailing stems which strike

root as they creep over the sand. The "Ipes-Caprae formation" and the "Canavali association" are common to tropic sea shores where investigations have been made (Warming, 1909).

The plant communities of the upper beach are not continuous and where the natural vegetation has been little disturbed by man, the landscape is not in the least monotonous, for it is ever changing. The beach associations (Tansley, 1921; Nichols, 1923) consist of many halophytic species, the most conspicuous adaptation being their succulence. The most frequent associations are Uniola - Cakile which appear intermittently throughout the length of the beach. Here and there is a pure growth of sea oats in a somewhat lower area, part of which may be inundated at high tide. These associations dominate areas from 30 to 70 feet in length along the beach and lie in a belt from 10 to 25 feet in width through a slight elevation from the tide line to the crest of the dune.

Sea purslane (Sesuvium Portulacastrum) probably appears more frequently than any other species except Uniola paniculata (Fig. 1). Sesuvium, often accompanied by the euphorbs Chamaesyce buxifolia and Pithymalopsis polyphylla, forms low rather inconspicuous mats. Croton punctatus is a woody perennial characteristic of this area.

Though the Uniola - Sesuvium and Uniola - Cakile associations are the most frequent ones on these coastwise dunes, there are some less frequent ones that are much more showy. Among

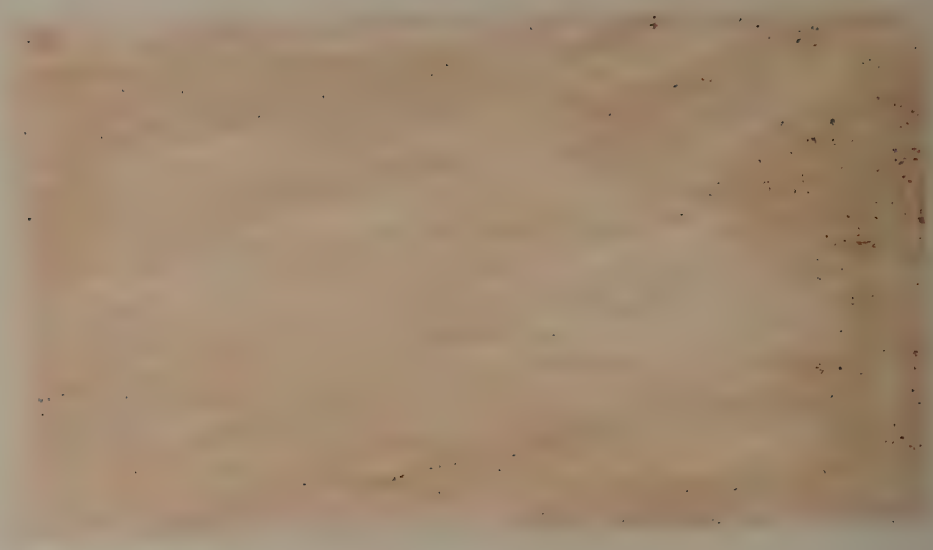
them are Wallotonia - Suriana, Scaevola - Batis, Sakile - Hymenocallis, Sesuvium - Chamaesyce, and Croton - Sesuvium. Sometimes a single species is found growing extensively and independent of any other species, or there may be other combinations of these more conspicuous plants.

The thick, grayish-green pubescent leaves borne on the large mounds of sea lavender (Wallotonia gnaphaloides) give the plants the appearance of being in full bloom when viewed from a distance (Fig. 2). Bay cedar (Suriana maritima) is conspicuous with cup-shaped clusters of small leaves, concealing inconspicuous yellow flowers. On several parts of the beach they form extensive masses, growing from 3 to 6 feet tall and covering 75 to 100 feet along the upper beach. Scaevola flumieri with large, thick, succulent leaves is noteworthy, and in marked contrast to the saltwort (Batis maritima) which has very small, light green, succulent leaves and a rather low, spreading prostrate stem. Often small sea grapes (Coccoloba uvifera) that have crept into this region form a contrasting background with large, shiny, leathery leaves.

A spider lily (Hymenocallis keyensis) which appears in every type of habitat found on the Key is as important here on the beach as in the mangrove swamps (Fig. 1). The same is true of the ubiquitous sand spur (Cenchrus pauciflorus) which abounds on the Key where ever there is sandy soil.

Fig. 1
A typical beach scene with *Uniola paniculata* and clumps of *Sesuvium Portulacastrum* and *Hymenocallis kevensis* in the fore ground

Fig. 2
Mound of *Mallotonia gnaphalodes* with *Casuarina equisetifolia* and *Serenoa repens* in back ground



Beach Ridge

Just above the beach community lies the less xeric beach ridge, so called for lack of a better term. If the slopes were higher, it would be termed a dune community. There is no sharp line between the vegetation of the ridge and that of the beach as the slope to the ridge is so gradual.

The beach ridge vegetation of practically all parts of the island is characterized by the trio Serenoa repens, Coccoloba uvifera, and Hymenocallis expansis. On many parts of the ridge, sea grape is the dominant species, masses of these woody plants towering 30 or 40 feet above their associates, while in other places the saw palmetto predominates. Spider lilies are far less conspicuous and are seldom seen in bloom.

In places black bead (Pithecolobium guadelupense) covers large areas where it is decidedly the dominant tree, though it is not as consistently regular in its appearance as the ones previously named. Other small woody trees of the beach ridge are Sophora tomentosa, Randia aculeata, Sapanea guyanensis, Cassasia clusiifolia, Ernodea littoralis, Torrubia longifolia, and Simarouba glauca. An occasional coconut tree (Cocos nucifera) and buttonwood (Conocarpus erecta) are seen though they are not common to the beach flora of Key Biscayne.

At recurring intervals, pure stands of the broad-leaved Reastorhyllum Reastorhyllum have almost monopolized areas from 15 to 100 feet in length. It is usually only a shrub but here it may frequently reach the size of a small tree. With its

long trailing branches it may form almost impenetrable jungles. Some of these stands are in protected places, others are directly behind the low upper beach plants where they are constantly exposed to the winds. While this tree is maintaining itself remarkably well, it does not seem best adapted to the exposed parts of the beach.

Interspersed with the ridge vegetation are clumps of the composites Baccharis halimifolia, B. angustifolia, Eupatorium capillifolium, E. serotinum, Chaethuga laciniata and L. virginica. They are often 6 feet high and are very showy when seen in full bloom in the late summer and fall. Other shrubs often associated with these composites are poison wood (Metopium toxiferum), nicker bean (Guilandina crista), another cassia (Cassia Tora), Lantana camara, L. involucrata, gopher apple (Geobalanus oblongifolius), cocoplum (Chrysobalanus Icaco), Rivina humilis, Solanum bahamense, Psychotria nervosa, Erechtites hieracifolia, Leucorna paniculata, and Duchesnea indica.

It is well to be able to recognize poison wood for man is frequently as susceptible to its sap as to that of the familiar Rhus toxicodendron. On the Key most of the Metopium is no more than a shrub bearing characteristic shiny green leaves. Occasionally one encounters a plant that is 10 or 15 feet tall. However in some of the hammocks around Miami it grows to tree size, often having a trunk over 12 inches in diameter.

Nicker beans have their fruits in spikes but they are

better characterized by the numerous, long, recurved spines on the leaves, stems, and fruits. These plants are locally called "birds' nests" for the gray seed in the pods with very rough spiny external walls and a smooth inside surface do resemble birds' nests and eggs.

In the more open spaces there are scattered consociations of gopher apple (Geobalanus oblongifolius). It is well adapted to this area because it has subterranean stems and from these buried stems sends up erect branches (Small, 1919). Two other occupants of areas with sparse vegetation are Yucca aloifolia and Opuntia sp. The water conserved in these two succulents is probably transpired very slowly because of the thick waxy cuticle (Saber, 1933).

Heading the list of herbs found with the shrubs are the omnipresent sand spur (Cenchrus pauciflorus) and the beach sunflower (Helianthus debilis), both being found in fruit the year round. Other common herbs are Mentzelia floridana, Sida procumbens, S. rhombifolia, Okenia hypogaea, Flaveria linearis, and Livonea stimulosa.

Ridge Complex

Occasionally the ridge community becomes more complex and is composed of very dense growths of small, rather stunted trees, scattered palms, shrubs and lianas. As the shade is dense in most places, few of the sun-loving herbaceous plants of the sandy beaches grow here.

The trees include most of those previously named, though

they are usually more numerous and larger since the denseness of the vegetation enables each one to be a partial windbreak for the other. The Cabal Palmetto and the coconut palm (Cocos nucifera), the two tallest trees on the Key, are scattered through this ridge complex. Some of the coconuts may have escaped from cultivation, though most of them are probably native. On the southern part of the Key, Pithecolobium and Metopium, which grow 8 or 10 feet tall here, are the most frequent trees, while on the northern part Casasia clusiifolia, Sophora tomentosa and Eugenia buxifolia are most frequent (Fig. 3).

Australian pine (Casuarina equisetifolia) is present in numbers in the northern part of the Key. It is not native and its frequency shows how well it has adapted itself to conditions here.

The lianas are quite conspicuous elements in the ridge complex. They include several species of Smilax, Rusocadinia Hunsoniana, Parthenocissus quinquefolia, and Melothria pendula. Cassytha filiformis is a parasite limited to the Keys and peninsular Florida. It so closely resembles the dodder in character and color that it is often confused with it. It thrives equally well on herbaceous and woody plants.

Fig. 3
Beach ridge on the northern end of the Key showing
Casasia clusiifolia
in flower and fruit

Fig. 4
In moist palmetto thicket
Salix amphibia
in the back ground
Acrostichum daneaefolium
and Dryopteris normalis
in the fore ground

Palmetto Bushland or Thickets

Though most of the interior of Key Biscayne was formerly covered with a pine-palmetto growth, the pine has practically disappeared due to three forces, man, fire, and storm. In the remaining native areas, two members of the palm family are the dominant species, saw palmetto (Serenoa repens) and cabbage palmetto (Sabal Palmetto). Much of the Pinus caribaea was felled for lumber soon after the purchase of the Key in 1908 and most of the remaining pines were killed in the 1926 hurricane. Some stumps of the felled trees were seen but the only living tree seen by the writer (Fig. 5) was in the inner mangrove association near the transition area between the mesic region and the mangrove swamp, an unexpected place to find pines, for the section was more swampy than mesic.

The existing native areas in this region are of two types, those in which the entire area is on higher sandy land and those where part of the area, usually the outer edges, may be high but those interior is swampy to the extent of being a foot or more under water in the rainy season. In either place, the palmettoes are so dense and thick that their touch overlapping fronds make entrance into the thickets difficult. When one views the seemingly solid masses of palms from an elevated position outside, the aspect is that of a pure stand with no other plants of any size. On gaining entrance, one finds this is not true.

In the higher palmetto sections and on the outer and upper parts of the palmetto depressions, the accompanying small trees

and shrubs include many of those found on the beach ridge, with the addition of frequent wax myrtles (Cerothamnus ceriferus) and a few red bays (Tamala borbonia). Conocarpus, which is more abundant here than in the coastal communities, and Cerothamnus are low and very stunted in appearance, indicating that they are not growing under ideal physiological conditions. The most frequent shrubs are Psychotria, Metopium, Sapanea, and papaya (Carica Papaya), whose palmately veined leaves, 12 to 18 inches in diameter, provide a pleasing contrast. Like the shrubs, the dwarfed herbs are scattered. Among them are Wentzelia, the rambling Momordica, Tuscadinia, Smilax, and Lantana and Rivina, which in other communities are more often shrubs. Andropogon glomeratus, Panchrus pauciflorus, and Spartina sp. were the only grasses observed.

In the lower places, where there is a tendency toward swampy conditions part of the year, Salix caroliniana, the only willow common to this section of Florida, is found. The willow makes a fitting background for the heavy giant fern (Acrostichum danaeaefolium) and the smaller, daintier Dryopteris normalis and Osmunda regalis (Fig. 4). To make this group complete, there must be included saw grass (Mariscus jamaicensis), so abundant in all low, marshy places, whether salt or brackish water is present. In this type of habitat, Mariscus is one of the most conspicuous herbs.

The two species of Baccharis and a Eupatorium are common in the edges of the moister thickets, occurring less often in the drier ones. In the late summer and early fall, these white

flowered composites, along with the many, single, elongated, lavender spikes of the legume Petalostemon and the yellow four-petalled Ascyrum are prominent. Scattered, few in numbers, yet characteristic of depressions are the small herbs Hydrocotyle, Bacopa, Ludwigia, Polypremum, Conoclinium, and Lunaria.

Ecologists have not reached an agreement about the position of hammocks in the development of the flora. From the standpoint of the physiognomy of the vegetation, a hammock is a group of hardwood trees, shrubs, vines, terrestrial and epiphytic herbs scattered as islands about the country (Harshberger, 1914). Usually humus soil, which is very retentive of water, is more abundant in hammocks than in the other areas. The tropical hammocks are generally classified as high and low.

While there seem not to be any typical hammocks on the Key, in parts of the coastal region and more often in the palmetto thickets, there are many plants which are common to hammock areas.

Below is a list of characteristic hammock plants which are found on Key Biscayne:

Small Trees

Coccothrinax Garriferus

Sabal Palmetto

Sapindus saponaria

Morus rubra

Dimorphandra flavescens

Metopium toxiferum

Tamala portoricensis

Vines

Muscadinia Munsoniana

Parthenocissus quinquefolia

Smilax spp.

Shrubs

Callicarpa americana

Psychotria nervosa

Solanum verbascifolium

Rivina humilis

Melanthera deltoidea

Lantana involucrata

Ionsorea paniculata

Serenoa repens

Acnbors tomentosa

Herbs

Dryopteris normalis

Aichromena colorata

Tillandsia balbisiana

Tillandsia aloifolia

Encyclia tampensis

Lamia interifolia

Cleared Fields

The coconut grove covers cleared sections of all communities of the Key except mangrove swamps, thus the flora shows marked similarities to the adjacent native areas. Since the original clearing and planting of the coconuts in 1910, when cabbage palmettoes, saw palmettoes and Caribaean or slash pines were the only trees of any consequence, the second growth has been little disturbed except when shrubs and undergrowth interfered with the coconuts.

While dry, sandy soil covers most of the area, there are scattered lower spots where the soil is rich in humus and as a result the flora is more luxuriant.

There are some species common to practically all this area. Some of the species characteristic of the natural communities are also found here. As this expanse is surveyed, it is clearly shown how great a difference in flora is produced by a change in elevation of only a few feet.

In the higher, dry, sandy places over practically all the cleared land where there has been little recent cultivation, the coverage is dominantly Melanthera sp., Catherantbus roseus, and Bentzelia floridana. Bentzelia is almost as much a pest as Cenchrus. The numerous barbed hairs are present not only on the capsule-like fruit but also on both lower and upper surface of the leaves.

Vigna repens, Galactia pendula, and Momordica Charantia ramble over much of the area and where the ground cover is not too thick, Rivina humilis is found in abundance. Simpson

(1932) says that Rivina was not at all common until after the big hurricane in 1926 after which "it has come up like an invading army".

On much of the higher section of the central and southern cleared areas of the Key, the lead tree (Leucaena glauca), a white flowered mimosa, is the most prominent woody shrub. Occasionally in the fields but more often near the road are extensive growths of ground apples (Pecobalanus oblongifolius).

The large shrubs Baccharis, Eupatorium, Phaethusa, and Lantana are more or less constant over the cleared fields. Of the herbs, Bidens pilosa, Cenchrus sp., and Rivinea stimulosa are the most widespread. Blue Commelina, the coral-colored composite Emilia coccinea, and Phyla nodiflora with procumbent creeping stems are other frequent but inconspicuous herbs.

In places of slightly lower elevation, the association of Helianthus-Catharanthus is common, while in places that are still lower and deeper, the giant fern (Acrostichum danaeifolium) is dominant.

The most luxuriant growth is found in a number of isolated spots near the ridge community. Much of it bears a strong resemblance to the flora already described in the beach ridge section. Metopium, Psychotria, and Coccoloba are broad-leaved species frequently found here but all of them are small shrubs. Trees encountered include some species not seen elsewhere on the Key, some of which may have been introduced from the mainland while others are exotic. They are Alliazia latifol, Morus rubra, Sabal Palmetto, Psidium Guajava, Thespesia populnea,

Moringa Moringa, Ficus religiosa, F. Sycomorus, Terminalia Catappa, and Pithecolobium dulce.

In most of the recently and regularly cultivated places, natal grass (Tricholaena rosea) forms a complete ground cover accompanied by an abundance of Spanish needle (Bidens pilosa) although Baccharis and Eupatorium, being much larger plants, are the most conspicuous species. Pluchea odorata, Erechtites hieracifolia, and Ambrosia elatior along with Bidens pilosa are frequently near the base of the coconut trees.

Mangrove Swamps

The mangrove swamps on the leeward shores bordering Biscayne Bay are in shallow salt water, where they are subject to very little wave action. Whether the soil is sand, loam or the rocky outer shore appears not to affect the mangrove for it seems to grow equally well in all of them.

The red mangroves (Rhizophora Mangle) which form the outer edge of the swamps present a very uniform appearance. All are rather low and spreading with very few over 15 feet tall. They are characterized by stilted aerial roots (Fig. 7). Some single trees bravely stemming the tide grow on salt flats from 5 to 25 feet from shore indicating that some day there may be land where they are now standing. Landward from the pioneer red mangroves is a zone of black mangroves (Avicennia nitida), and nearer shore, interspersed with these are white mangrove (Laguncularia racemosa) and buttonwood

Fig. 5
The only Pinus caribaea seen on Key Biscayne
Conocarpus erecta and Serenoa repens
in the fore ground

Fig. 6
Avicennia nitida
showing
pneumatophores

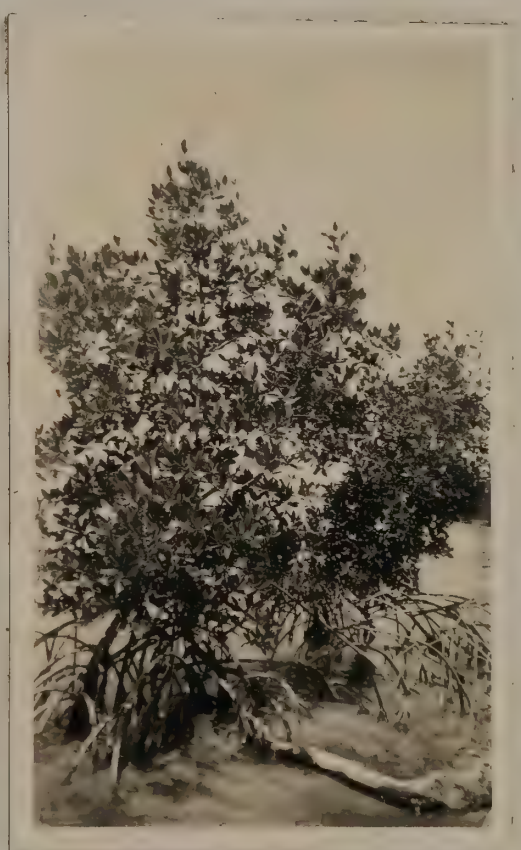


Fig. 7
Rhizophora Mangle
with
adventitious roots

(Conocarpus erecta). All of these trees may help convert this swampy area into dry land (Harshberger, 1911).

Much has been written about the mangroves as land forming agencies (Curtiss, 1888; Sargent, 1891; Tollard, 1902). Like coral, they work so slowly that even in the course of a few hundred years the addition made by them would not be noticeable to the casual observer. The amount of land added to the area of Florida in a the sand years cannot be more than a few square miles according to Harper.

The red mangrove (Rhizophora Mangle) is probably the most talked of tree which is instrumental in aiding in land formation. It is conspicuous with its opposite, leathery, dark green leaves but its most unusual feature is the rare phenomenon of viviparty it shows. In this species the embryo plant, while still attached to the parent, develops a stem 8 to 12 inches long without undergoing a rest period. Such behavior is abnormal in most other plants but quite normal in this species (Warming, 1909). When the seedling breaks loose, the basal end which is heaviest, is very apt to strike the soil first, thus effecting an upright position. If given favorable conditions, by the time the young plant has attained the height of 4 or 5 feet, adventitious roots begin branching and arching outward and downward, until they reach the level of the briny tide water which floods them twice each day. These arched aerial roots attach themselves by rootlets as the tip penetrates solid ground, whether above or below the surface of the water. If the depth of the

water exceeds a foot at high tide the roots usually branch and thus serve to support the plant in its march seaward. These flying buttresses or basal branches serve the dual purpose of props and feeders. So far as there has been a struggle for the existence of the plant itself. Now that it is well anchored, its work of land building begins.

The mass of intertwining, stilt-like roots serves as a net to catch any tidal drift, silt and sand. As much of the organic matter that washed in decomposes, this affords a rich medium for seed development. When a woody branch of the red mangrove sinks in the water, it is not attacked by the Teredo, as these ~~marine~~ molluscan ship worms do not relish the tannin it contains (Curtiss, 1880). Thus, pieces that fall, remain to further assist the intricate and complex root system in holding back any debris brought in by the ocean currents. This is, in brief, the method of land building as started by the red mangrove, acting as a forerunner, furnishing a foundation on which other plants will grow.

The black mangrove (Avicennia nitida), so named because of its heavy black wood, also has a peculiar habit of growth enabling it to continue the work begun by its ally. It is taller and more erect than Rhizophora with foliage dull green above and grayish below. The surface roots of the trees growing at the water's edge send out short feeders, black and lithe which barely rise above the surface of the water. The feeders or pneumatophores evidently function in obtaining nutrients from the water at high tide and aid the

roots in the exchange of gases (Fig. 6). By forming loose mats, they are important agents in fixing the muddy bottom and further aid in adding to the surface accumulations (Curtiss, 1888). While some of these are at the water's edge where the roots are submerged at each rising tide, many others are farther back in less watery places where the vertical root branches are constantly exposed, the feeders often being much branched and asparagus-like in appearance. Very fine specimens of these trees are to be found on the sandy tidal flats at Baer's Cut.

When proceeding landward, white mangrove (Laguncularia racemosa), with oval shaped leathery leaves, and buttonwood (Conocarpus erecta), with smaller leaves clustered at the ends of the branches, are the most numerous trees in the swamp. The same conspicuous groupings were found when the swamp was entered from Hacienda Cock and from the lineman's path which is a foot path that follows the telephone wires across the Key. In general, on higher areas of the mangrove region, the white mangrove and buttonwood have very nearly taken possession. Neither of these trees is structurally adapted to a physiologically dry habitat other than being evergreen species of the sclerophyllous type (McDougall, 1931).

In parts of the mangrove swamps, there are many buttonwoods, much branched and gnarled, vividly portraying past struggles with the elements. While there are some young individuals, the number is relatively small compared to the

older ones. On the other hand, while there are not as many mature white mangroves as buttonwoods, yet along the edges of the ditches through the swamps there are myriads of young white mangroves. Some are 2 to 6 inches high, many more are 2 to 3 feet tall. The numerous, young white mangroves can probably be attributed to drainage.

White mangrove is by no means to be associated only with mangrove swamps, for there is hardly a ditch or any other water on Key Biscayne where it is not attempting a reclamation project on a small scale. Here is seen a sharp contrast between the red and white mangrove. While the red mangrove is always advancing into new territory, the white mangrove tends to migrate toward those areas which are old, vegetationally, and almost mesic in character. It also grows on sandy shores and at a slightly higher elevation. However, it seems to grow better where its roots are partially or wholly submerged.

Buttonwood is the most conspicuous additional element in the inner edge of the mangrove community. It may well be termed a transition tree for it is often present on higher elevations of the Key as well as in the mangrove swamps. There is much concern on the Keys south of Miami for the survival of buttonwood as so much of it is used on fishing and sponge boats for charcoal because it produces hot flames without the attendant smoke (Gifford, 1934). At present there is no danger of the species disappearing from Key Biscayne.

In the inner mangrove areas, the cabbage palmetto (Sabal Palmetto) is often present. It is another of the ubiquitous plants of peninsular Florida (Small, 1933), growing equally well on dry land, in mangrove swamps, or even on the most barren soil.

A few succulent herbs in the interior of the swamp are the only other plants present besides the four typical mangrove species and Sabal Palmetto. The most frequent ones, which are in the more open spaces, are the pale green prostrate patches of Batis maritima and Salicornia perennis, and more scattered growths of Sesuvium Portulacastrum and Sondia linearis. These low spreading succulents present a sharp contrast to the dark green of the mangrove foliage overhead. In August all of the above named herbs are in flower.

The giant fern (Acrostichum daneaefolium) with heavy fronds from 3 to 6 feet long in an imposing and conspicuous member of the mangrove association. It is to be found fruiting at most seasons of the year.

On the less swampy inner areas, where the mangrove meets higher land, Ecastophyllum Ecastophyllum with its woody stem and long trailing branches furnishes an ideal place for the composite Mikania batatifolia to climb. Sophora tomentosa, a taller legume, is often associated with Sondia acaleata, easily recognized by its alternate and opposite branches, placed at right angles to the main stem. Still others that sometimes appear as small trees and at other times as shrubs are Cerothamnus Ceriferus, Iaurela Borbonia, Myrsine buxifolia

and an occasional Metopium and Coccoloba.

Though scattered clumps of shrubs are numerous, the composites Borrichia frutescens and Pluchea spp. are characteristic of this area. They are often accompanied by extensive growths of Baccharis and Eupatorium, which are the most cosmopolitan shrubs of the Key.

South of the linesman's path the same general conditions are found up to the inner margin of the swamps where it merges into the mesic habitats. In spots the comparatively rapid lowering of the water table has probably been the cause of some of the white mangroves and buttonwoods either dying or looking yellow and unhealthy. Cabbage palmettoes, some tall and erect and others with crooked lateral trunks, at times dominate the more typical trees of the habitat.

The only epiphytes found on the Key were in the mangrove swamps and for some unknown reason, all were in one limited area, growing only on the 2 species of the white mangrove family native to the Key. Many more were found on white mangroves than on buttonwoods. The bromeliads collected are Tillandsia Balbisiana, T. algifolia and Dendropogon usneoides. A single species of epiphytic orchid (Encyclia tampensis) was collected.

The habitat of the single bryophyte found was also in the mangrove swamp. This species (Octoblepharum albidum) was only collected on Sabal Palmetto, some on live and some on dead trunks.

Several unidentified species of lichens were found on the trunks and branches of white mangroves.

SUMMARY

1. Key Biscayne, one of the upper sand keys, lies at the southern extremity of a sandy barrier beach. It is an island of little relief.

2. The flora consists for the most part of tropical and subtropical species. Few of them are endemic to south Florida, probably most of them having been brought over by wind, water, or birds from countries south of Florida.

3. The plant communities, resulting from a number of factors, the most definite being the interaction of soil and elevation, may be divided into three natural groups: coastal, palmetto bushland, and mangrove swamp. The cleared areas include vegetation of all types except mangrove swamp.

4. The three divisions of the coastal region, beach, beach ridge, and ridge complex, vary decidedly both in aspect and floral composition. The flora of the beach is low and scarce because of the easterly wind and salt spray. The flora of the ridge and ridge complex tends to become more mesic. On the beach, lianas are conspicuously lacking, although they are numerous in the ridge and ridge complex.

5. The palmetto bushland or thicket, formerly pine-

palmetto growth, consists of very dense growths of palms with relatively few herbs and shrubs.

6. Though there are no communities that may be called tropical hammocks, there are many typical hammock plants which seem to be more frequent in the palmetto thickets. Many of the large trees characteristic of hammocks on the mainland are represented on the Key by small trees or shrubs.

7. Mangrove swamps on Key Biscayne are found only on the quiet, leeward shores of Biscayne Bay. All epiphytes observed in this study were found on members of the mangrove group.

8. The physiologically xeric conditions have produced two distinct types of plants: succulent herbs and evergreen shrubs and trees of a sclerophyllous type.

9. The hurricane, as a periodic climatic factor, must be considered in analyzing the flora, both in its limiting and liberating effects.

10. The species most typical of each community are given with the discussion of the community. All Pteridophyta and Spermatophyta collected during this study are listed in the Appendix.

APPENDIX

LIST OF SPECIES COLLECTED

APPENDIX

LIST OF SPECIES COLLECTED[1]

PTERIDOPHYTA

Filicales
Osmundaceae
Osmunda regalis L.

Polypodeaceae
Acrostichum danaeaefolium Langsd. & Fisch.
Pteropteris normalis C. Chr.

SPERMATOPHYTA

Gymnospermae

Cycadales
Cycadaceae
Zamia integrifolia Ait.

Pinales
Pinaceae
Pinus caribaea Morelet

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[1] Species marked with an asterisk are exotic.

Angiospermae

Monocotyledones

Pandales
Typhaceae
Typha latifolia L.

Poales
Poaceae
Andropogoneae
Andropogon glomeratus (Walt.) B. S. P.

Paniceae
Stenotaphrum secundatum (Walt.) Kuntze
Chaetochloa geniculata (Lam.) Millsp. & Chase
Cenchrus pauciflorus Benth.
Cenchrus echinatus L.
Trichachaena rosea Nees.
Echinochloa Crus-galli (L.) Beauv.
Paspalum ciliatifolium Michx.
Paspalum Urvillei Steud.
Panicum adspersum Trin.

Agrostideae
Sporobolus Poiretii (Roem. & Schult.) Hitch.
Capriola dactylon (L.) Kuntze

Chlorideae
Chloris petrea Swartz.

Festuceae
Spartina sp.
Eragrostis ciliaris (L.) Link.
Uniola paniculata L.

Cyperaceae
Scirpeae
Cyperus odoratus L.
Cyperus polystachyos Rottb. var. *leptostachyus* Boeck.
Cyperus alternifolius L.
Cyperus esculentus L.
Cyperus lineolaris L.
Cyperus planifolius L. C. Mich. var. *Ottonis* (Boeck.) Kukenthal
Cyperus retrorsus Chapm. var. *Nashii* (Britt.) Fernald & Griscom.

Fimbristylis spadicea (L.) Vahl.
Fimbristylis castanea (Michx.) Vahl.

Eleocharis atropurpurea (Retz.) Kunth.

Rynchosporeae
Dichromena colorata (L.) A. Hitchc.
Rynchospora caduca All.
Mariscus jamaicensis (Crantz) Britton

Arecales
Arecaceae
Sabal Palmetto (Walt.) Todd.
Serenoa repens (Bartr.) Small
Cocos nucifera L.

Commelinales
Commelinaceae
Commelina angustifolia Michx.

Bromeliaceae
Dendropogon usneoides (L.) Raf.
Tillandsia Balbisiana Schult.
Tillandsia aloifolia Hook.

Liliales
Juncaceae
Juncus megacephalus M. A. Curtis

Dracaenaceae
Yucca aloifolia L.

Smilaceae
Smilax auriculata Walt.
Smilax Bona-nox L.
Smilax spp.

Amaryllidales
Leucojaceae
Hymenocallis kayensis Small

Ixiaceae
Sisyrinchium capillare Bicknell

Orchidales
Orchidaceae
Encyclia tampensis (Lindl.) Small

ANGIOSPERMAE

Dicotyledones

Choripetalae

Casuarinales
Casuarinaceae
Casuarina equisetifolia Forst.

Myricales
Myricaceae
Cerothamnus ceriferus (L.) Small

Salicales
Salicaceae
Salix amphibia Small

Urticales
Urticaceae
Boehmeria Drummondiana Wedd.

Artocarpaceae
*Ficus religiosa L.
*Ficus sycomorus
Morus rubra L.

Polygonales
Polygonaceae
Coccoloba uvifera (L.) Jacq.
Eriogonum floridanum Small
Persicaria Opelousana (Riddd.) Small

Chenopodiales
Chenopodiaceae
Ambrina ambrosioides (L.) Spach.
Salicornia perennis Mill.
Londia linearis (Mill.) Millsp.

Amaranthaceae
Amaranthus spinosus L.
Achyranthes ramosissima (Mart.) Standley
Iresine celosia L.
Philoxerus vermicularis (L.) R. Br.

Phytolaccaceae
Rivina humilis (Plum.) L.

Batidaceae
Batis maritima L.

Allioniaceae
Okenia hypogaea Schlecht. & Cham.
Boerhaavia coccinea Mill.

Piconiaceae
Torrubia lonsifolia (Meisner.) Britton

Tetragoniaceae
Sesuvium Portulacastrum L.

Portulacaceae
Portulaca phaeosperma Urban.

Papaverales
Papaveraceae
Argemone mexicana L.

Brassicaceae
Lepidium virginicum L.
Cakile lanceolata (Willd.) O. E. Schulz.
Cakile Cakile (L.) Karst.

Moringaceae
Moringa Moringa (L.) Millsp.

Rosales
Sedaceae
Bryophyllum pinnatum (Lam.) S. Kurz.

Amygdalaceae
Geobalanus oblanceifolius (Michx.) Small
Chrysobalanus Icaco L.

Mimosaceae
Pithecolobium guadelupense Chapm.
Pithecolobium dulce Benth.
Albizzia Lebbek (Willd.) Benth.
Vachellia peninsularis Small
Leucaena glauca (L.) Benth.

Cassiaceae
Adipera biocapsularis (L.) Britton & Rose
Emelista Tora (L.) Britton & Rose
Ditremexa occidentalis (L.) Britton & Rose
Peiranisia bahamensis (Mill.) Britton & Rose
Chamaecrista aspera (Muhl.) Greene
Delonix regia (Boj.) Raf.
Poinciana pulcherrima L.
Guilandina Bonduc L.
Guilandina crista (L.) Small

Fabaceae
Sophora tomentosa L.
Crotalaria incana L.
Crotalaria striata DC.
Crotalaria pumila Ortega.
Rhynchosia easteophyllum (L.) Britton
Petalostemon carneus Michx.
Galactia floridana T. & G.
Strophostyles umbellata (Muhl.) Britt.
Vigna repens (L.) Kuntze
Melbomia purpurea (Mill.) Vail.
Vicia acutifolia All.
Canavali lineata (Thunb.) DC

Geraniales
Rutaceae
Citrus aurantifolia (Christm.) Swingle

Surianaceae
Suriana maritima L.

Simaroubaceae
Simarouba glauca DC.

Polygalales
Polygalaceae
Asemeia grandiflora (Walt.) Small

Euphorbiales
Euphorbiaceae
Croton glandulosus L.
Croton punctatus Jacq.
Bivonea stimulosa (Michx.) Raf.
Ricinus communis L.
Chamaesyce Blodgettii (Engelm.) Small
Chamaesyce buxifolia (Lam.) Small
Chamaesyce scoparia Small
Chamaesyce hypericifolia (L.) Small
Tithymalopsis polyphylla (Engelm.) Small
Calarhoeus trichotomus (H.B.K.) Small
Poinsettia pinetorum Small
Poinsettia heterophylla (L.) Small
Euphorbia Tirucalli L.
Phyllanthus Garberi Small

Sapindales
Spondiaceae
Mangifera indica L.
Metopium toxiferum (L.) Krug. & Urban.
Rhus leucantha Jacq.

Rhamnales
Vitaceae
Muscadinia munsoniana (Simpson) Small
Parthenocissus quinquefolia (L.) Planch.

Malvales
Malvaceae
Sida procumbens Sw.
Sida rhombifolia L.
Hosteletzkya althaeifolia (Chapm.) A. Gray
Thespesia populnea (L.) Soland.

Hypericales
Hypericaceae
Ascyrum tetrapetalum (Lam.) Vail.

Turneraceae
Piriqueta caroliniana (Walt.) Urban.

Passiflorales
Papayeceae
Carica Papaya L.

Opuntiales
Loasaceae
Mentzelia floridana Nutt.

Opuntiaceae
Opuntia sp.

Proteales
Proteaceae
*Grevillea robusta A. Cunn.

Thymeleales
Lauraceae
Tamala Borbonia (L.) Raf.

Cassythaceae
Cassytha filiformis L.

Myrtales
Lythraceae
Lythrum lineare L.

Terminaliaceae
Conocarpus erecta L.
Terminalia Catappa L.
Laguncularia racemosa Gaertn. f.

Myrtaceae
Eugenia buxifolia (Sw.) Willd.
Psidium Guajava Raddi.

Rhizophoraceae
Rhizophora Mangle L.

Epilobiaceae
Gaura simulans Small
Isnardia intermedia Small & Alexander
Ludwigia microcarpa Michx.
Ludwigia lanceolata Ell.
Haimannia hirtiflora (Nutt.) Rose

Ammiales
Amaiaceae
Hydrocotyle Canbyi Coult. & Rose

DICOTYLEDONAE

GAMOPETALAE

Ericales
Ericaceae
Befaria frutiosa (Michx.) Nash

Primulales
Primulaceae
Samolus floribundus H. B. K.

Ardisiaceae
Bonamea guayanensis Aubl.
Jacquinia paniculata (Nutt.) Sudw.

Ebenales
Sapotaceae
Sapo a Achras Mill.

Gentianales
Spigeliaceae
Cynoctonum mitreola (L.) Britton
Polypremum procumbens L.

Gentianaceae
Eustoma exaltatum (L.) Griseb.

Asclepiadales
Apocynaceae
Catharanthus roseus (L.) G. Don
Urechites lutea (L.) Britton
Echites echites (L.) Britton

Asclepiadaceae
Asclepias curassavica L.
Lyonia palustris (Pursh.) Small (Leutera palustris Vail)
Carissa grandiflora A. DC.

Polemoniales
Convolvulaceae
Evolvulus sericeus Sw.
Cuscutella dissecta (Jacq.) House
Jacquemontia cathartica (Poir.) Choisy
Ipomoea Pes-Caprae (L.) Sweet

Solanaceae
Solanum nigrum L.
Solanum aculeatissimum Jacq.
Solanum bahamense L.
Solanum Blodgettii Chapm.
Cestrum diurnum L.

Heliotropiaceae
Heliotropium angiosperma Murr.
Heliotropium polyphyllum Lehm.
Lobelia nicotianaefolia Heyne ex Roem. & Schult.

Verbenaceae
Glandularia maritima Small
Lippia nodiflora (L.) Greene
Valerianoides Jamaicensis (L.) Kuntze.
Lantana Camara L.
Lantana ovatifolia Britton
Lantana involucrata L.
Callicarpa americana L.

Avicenniaceae
Avicennia nitida Jacq.

Lamiaceae
Trichostema suffrutescens Kearney

Rhinanthaceae
Agalinis fasciculata (Ell.) Raf.

Rubiales
Rubiaceae
Casasia clusiifolia (Jacq.) Urban.
Randia aculeata L.
Psychotria nervosa Sw.
Psychotria bahamensis Millsp.
Galium bermudense L.
Ernodea littoralis Sw.

Campanulales
Cucurbitaceae
Melothria pendula L.
Momordica charantia L.

Brunoniaceae
Scaevola plumieri Vahl.

Cardunales
Ambrosiaceae
Ambrosia elatior L.
Iva imbricata Walt.

Cardueae
Eupatorium semiserratum (Lam.) Small
Eupatorium serotinum Michx.
Conoclinium coelestinum (L.) DC.
Mikania batatifolia DC.
Solidago leavenworthii T. & G.
Leptilon canadense (L.) Britton
Baccharis halimifolia L.
Baccharis angustifolia Michx.
Pluchea petiolata Cass.
Pluchea odorata Cass.
Pterocaulon undulatum (Walt.) C. Mohr.
Melanthera deltoidea Michx.
Melanthera angustifolia A. Rich.
Wedelia trilobata (L.) A. Hitchc.
Helianthus debilis Nutt.
Borrichia frutescens (L.) DC.
Pluchea purpurascens (Swartz) DC.
Pluchea virginica (L.) Cass.

Pterophyton helianthoides (Michx.) Alexander
Bidens pilosa L.
Silphium lireariifolium Lag.
Cacalia leptocephala (Cass.) Urban.
Emilia coccinea (Sims.) Sweet
Erechtites hieracifolia (L.) Raf.
Cirsium horridulum Michx.

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